Assessing National Spectrum Management Practices and creating NTFA

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Introduction

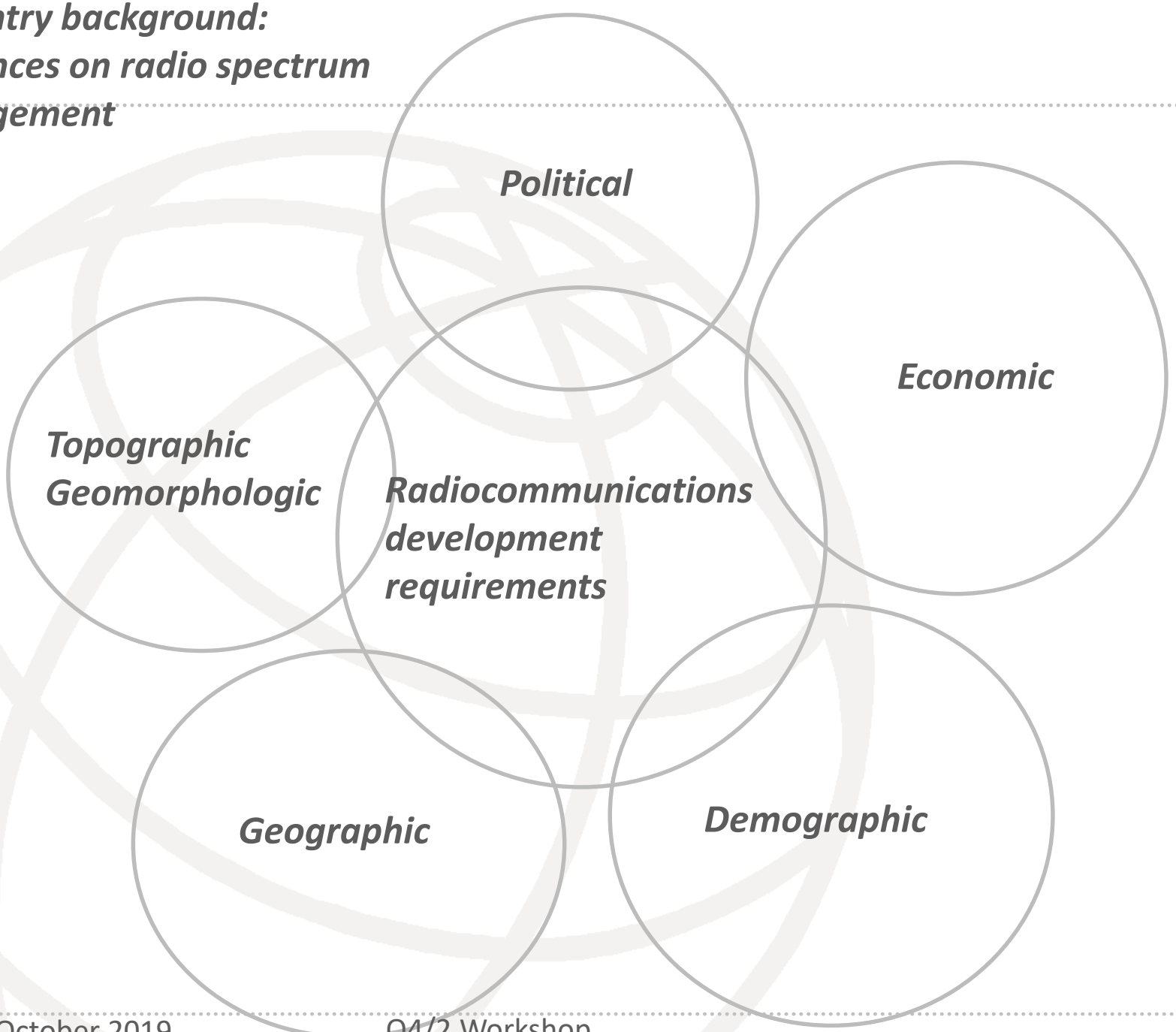
- It is a government responsibility to develop spectrum management policies that conform to the international treaty obligations of the Radio Regulations while meeting national spectrum needs
- Within the national legal framework for telecommunications a spectrum management organisation has the delegated authority to prepare spectrum plans that meet government policies
- One of the most important tools for effective spectrum management is the National Table of Frequency Allocation (NTFA). This shows how the spectrum can be used in the country

Spectrum Management Assessment

1 Key elements of national spectrum management for review and assessment

1 Country background
2 Legal Framework for Spectrum Management
3 Organisational Structure of Spectrum Management
4 Current Spectrum Allocation & Usage as well as Future Trends
5 Spectrum & Apparatus Assignment/Licensing Processes/Mechanisms
6 Financing of Spectrum Management and Spectrum Pricing Mechanisms
7 Spectrum Quality Control, Interference Management & Enforcement
8 Spectrum Management Data Bases and Computer Assisted Assignment
9 Application of spectrum engineering in spectrum management and assignment
10 Radio Equipment Standardization, Type Approval & Related Certification
11 Participation in International Spectrum Planning and Co-ordination activities
12 Participation of Stakeholders in the Spectrum Management Process
13 Research Collaboration with Institutions of Higher Learning and Industry
14 Public Information; Websites; licensing

2 Country background: Influences on radio spectrum management



2 Country background: Influences on radio spectrum management

Political

Indication of organizational and legal structure; policies for liberalization and market approach. Regional administrative centres may require spectrum management on a regional basis. Different ethnic regions are likely to have regional broadcasting requirements.

Economic

Information on the role of radiocommunications in supporting major sources of Gross Domestic Product (GDP).

Demographic

Distribution of population, main cities and towns indicate areas of (future) high spectrum demand. Large, sparsely populated, rural areas indicate requirement for radio links to support infrastructure development and/or backhauling.

2 Country background: Influences on radio spectrum management

Geographic

Country size: radio coverage requirements; coastal areas: maritime requirements; number of neighbouring countries: cross-border frequency co-ordination requirements.

Topographic/Geomorphologic

Mountainous regions, flat plains, deserts, large inland water areas, large forests or jungle areas etc: different influences on radio use and planning requirements.

Assessment objectives

Pre-mission assessment and report on the key factors listed above. Information from publicly available sources (including ITU development reports). To be discussed and agreed with the administration while on-mission.

The international licensing requirement

- Article 18 of the Radio Regulations requires that: “No transmitting station may be established or operated by a private person or by any enterprise without a licence issued in an appropriate form and in conformity with the provisions of these Regulations by or on behalf of the government of the country to which the station in question is subject…”.
- ITU Constitution Article 45 requires each Member State to ensure that stations established and operated by its operating agencies do not cause harmful interference to stations of other Member States or of recognized operating agencies operating in accordance with the Radio Regulations.
- The administration must therefore have some form of licensing process to meet this requirement.

National licensing arrangements – the flexibility

Individual licensing

Usually required for "international" stations (e.g. aeronautical and maritime mobile) and for those transmitters which required individual frequency planning (e.g. interference analysis) including international co-ordination.

A general licensing regime

May be used for personal transmitters operating under the control of public mobile telephone networks designed to meet international standards. Various short range devices, including computer terminals in wireless local area networks, can operate under a general "licence exempt" basis, provided that the equipment conforms to an accepted standard on agreed frequencies.

8 Spectrum Quality Control, Interference Management & Enforcement

In order to guarantee that spectrum use conforms to existing regulations and the authorizations granted, there should be some form of spectrum monitoring capability.

The main purposes of spectrum monitoring are:

- To measure spectrum occupancy (to evaluate effectiveness of spectrum planning and identify geographical areas and bands having congestion)
- To verify administrative (licensing) database records
- To check technical compliance
- For interference resolution
- To trace unlicensed/illegal use

Equipment requirements of the Radio Regulations

- Article **3** of the Radio Regulations concerns the requirements associated with the technical characteristics of stations with the objective to avoid interference.

- Appendices **2** and **3,** respectively, of the Radio Regulations give maximum values for frequency tolerance and spurious emissions and other technical standards.

- Administrations have the responsibility to ensure that equipment authorised for use in their territory conforms to these Regulations.

11 Radio Equipment Standardization, Type Approval & Related Certification

Equipment standards

Documents which specify the minimum performance requirements for radio transmitters and receivers (or other equipment) and the associated procedures to ensure conformity with these requirements are commonly referred to as "equipment standards". Standards can be developed by national, regional or international organisations such as ITU.

Compliance testing , placing on the market, import restrictions

- Obsolete procedures

- Nationally developed standards
- *Every* country required a sample of each equipment to be submitted to its own government-run laboratory for "type-approval" to the relevant national standard before market.

- New procedures

✓A combination of: manufacturers' declaration of compliance, compliance testing by commercial test-houses, market surveillance,

✓Global standards , mutual recognition agreements (MRAs) of standards and approvals between countries or groups of countries.

The need for easily accessible, up-to-date and comprehensive spectrum information

All those involved in radiocommunications and telecommunications (users, potential users, operators, equipment suppliers etc.) need to be able to access, quickly and easily, timely an information about (e.g.):

- how spectrum is used (NTFA)
- what spectrum is available for particular purposes (NTFA),
- equipment specifications and standards (for each band/purpose),
- licensing processes and types,
- regulations and fees,
- proposed changes to regulations and spectrum use,
- opportunities and procedures to participate in the consultative process.

Information distribution through the internet and the administration's web-site is replacing the traditional official government gazette or journal.

National Table of Frequency Allocations (NTFA) preparation

1 Introduction

The Radio Spectrum	➢ **A major national asset** ➢ **Competing demands** ➢ **International obligations** ➢ **Harmonization**
National Spectrum Policies	➢ Conform to ITU Radio Regulations ➢ Meet national objectives
NTFA	➢ Outcome of national spectrum plan ➢ High level approval (government) ➢ Several levels of detail

1 Introduction

- **With changes in regulatory and technical approaches to spectrum management**

i.e. Administrative control >>>>> Market freedom

- **Do we still need an NTFA? >>>>> YES!!**
- **Regulators, Industry, Operators, General Users etc. need a publicly available, clear plan of the current and proposed national use of the spectrum**

RR General Scope

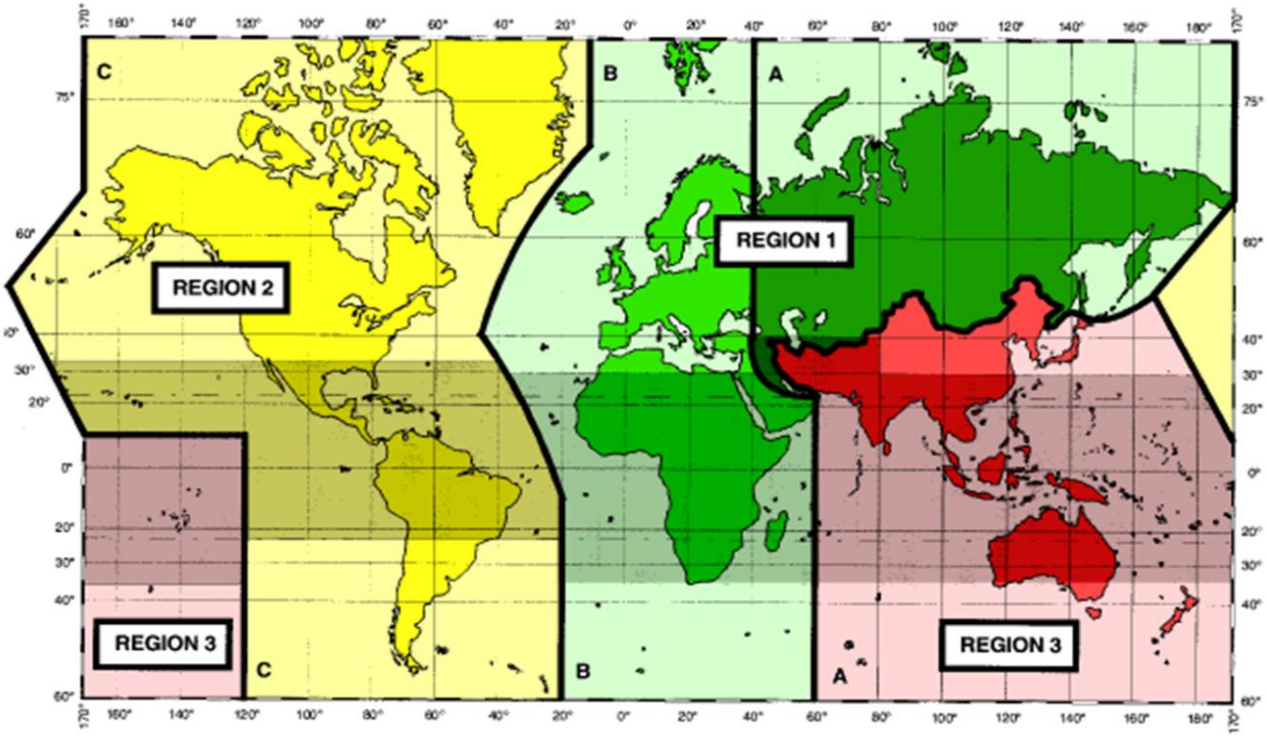
- Legal instrument for international coordination of spectrum use
- Provisions binding on ITU Member States
- Frequency sharing between services
- Use of satellite orbits
- Recognition of spectrum use and protection from harmful interference
- Revised regularly by World Radio Conferences (WRCs)

2 The ITU Radio Regulations Article 5: Definition of Terms and Table of Frequency Allocations

- **RR classifies services that use radio communications, according to several parameters, namely:**
  - *Link type: Terrestrial (earth to earth) or satellite (earth-satellite, satellite-earth, satellite-satellite)*
  - *Type of coverage: land, maritime, aeronautical*
  - *Station type: fixed, mobile*
  - *Type of use: communications, broadcasting, navigation and associated, meteorological, scientific, earth observation, time standard, astronomy, security, special.*
- **It also defines the different types of radio stations, classified as:**
  - *Terrestrial space*
  - *Land, sea, air*
  - *Fixed, mobile*
  - *Broadcasting, amateur radio, radio-astronomy, etc*
- **41 types of services and 53 types of stations (more stations than services, as some stations simultaneously involve several services)**

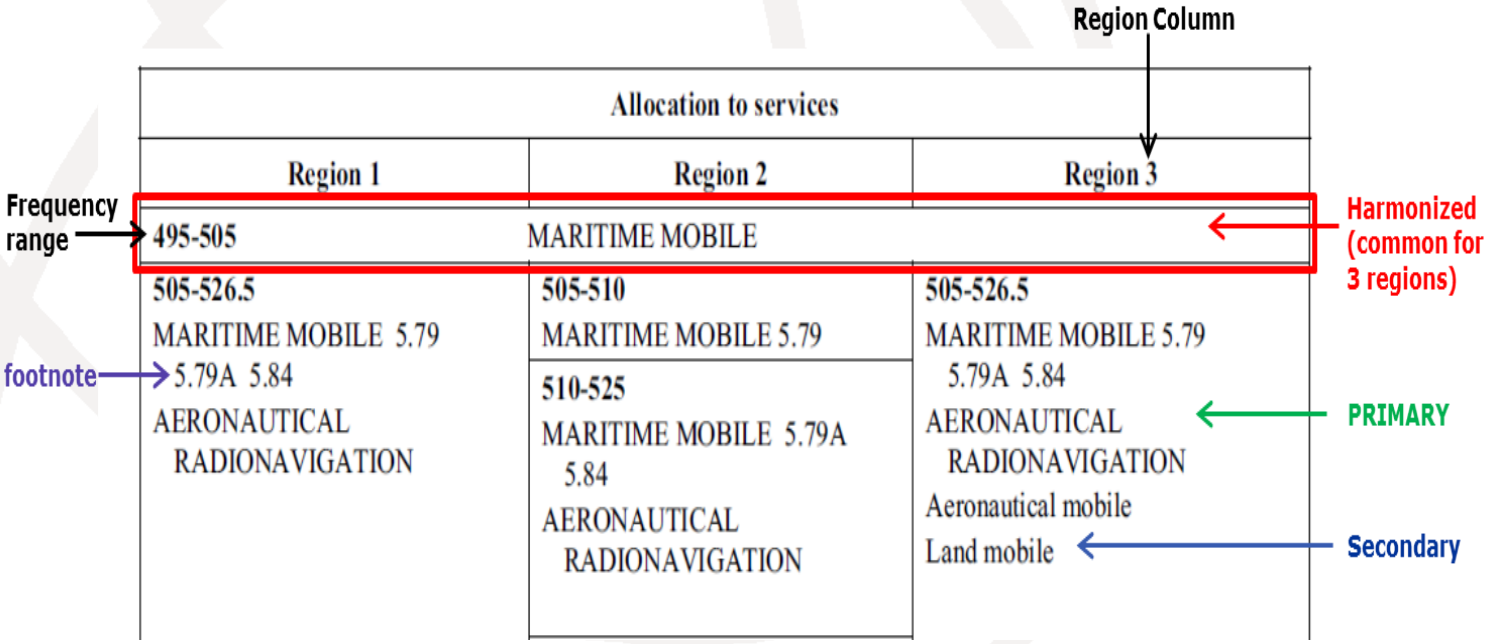
Key Definitions (RR Regions)

- Frequency bands are allocated to different services either worldwide (worldwide allocation) or regionally (regional allocation). The world is divided into three ITU Regions (Regions 1, 2, 3), as shown below.



Key Definitions (Table of Frequency Allocations)

- an excerpt of Table allocations in the RR, illustrating the different features of the Table (Frequency range, Worldwide & Regional allocations, Services (PRIMARY & Secondary), Footnotes.



2 The ITU Radio Regulations Article 5: Definition of Terms and Table of Frequency Allocations

RR and NTFA

The RR is an international Treaty, applicable to all ITU Member States, therefore the NTFA must be consistent with the RR. However, it also has to respond to national interests and needs in relation to spectrum usage. Some relevant considerations in this regard are as follows:

- ***Inclusion of Footnotes of the RR:*** NTFA might contain a different allocation than those in the RR Allocations table (Art. 5) basically: a) additional allocation (adding more services); b) different (alternative) allocations (allocating to other different services instead); c) change categories to allocated services (different categories).

As these differences were accepted by the competent WRCs and included in the RR, they enjoy international recognition (with the limitations contained in the respective footnote).

3 International and National spectrum management frameworks

- **Spectrum management: levels of authority**

International (worldwide level)

- The international framework for the use of the radio frequency spectrum is set out in a treaty – *the Radio Regulations* - ratified by the Member States of the International Telecommunication Union (ITU), a specialized UN agency.

International (regional level) (***Note: not ITU region***)

- Regional Telecommunication Organizations have been established (usually) by administrations to develop harmonization measures intended to facilitate free movement of telecommunication equipment and services within the region and to offer industry and operators the economies of scale through a larger market with common requirements.

Legal Basis for Spectrum Management

- The legal basis for the regulation of the spectrum is set out in ***Primary* legislation** with associated detailed regulations. Legislation should set out such things as definitions, powers of the Minister or head of the spectrum regulatory authority, the powers of others involved in spectrum regulation, offences and penalties and the organizational structure and framework for regulation of the spectrum.
- ***Secondary* legislation** can be used to allow the regulatory authority to issue or revise regulations without changing primary legislation.
- The primary telecommunications legislation should require and authorise the administration to establish a National Table of Frequency Allocations. However, some countries do not include the NTFA itself in the primary legislation.

National Spectrum Control and Enforcement

- National laws and regulations are useless unless the administration has the legal power and practical means to monitor whether actual spectrum use is in accordance with those laws and regulations and to take effective action against violations.
- national spectrum monitoring capability to obtain information on spectrum use and gather evidence of illegal activity to support subsequent legal action against offenders.
- unlicensed transmissions or operation that does not conform to the conditions of a licence.
- obligation to ensure all emissions from the country conform to the Radio Regulations and do not cause harmful interference to the services of other countries

5 National Spectrum Planning and the National Table of Frequency Allocations (NTFA)

Principles and objectives

- The NTFA is the published outcome of national spectrum planning.
- National spectrum planning should be one of the duties of the spectrum policy and strategy committee, including setting up regular reviews, in particular as part of the preparations for ITU radio conferences.
- Direct relationship between effective planning of the spectrum resource through the continuous review of NTFAs and the economic impact of national spectrum use through an effective and efficient spectrum allocation, consistent with international spectrum harmonization.
- Ensure technical compatibility but also *provide the legal/regulatory basis for maximizing economic output from the utilization of the spectrum resource in the particular context of the corresponding country.*

5 National Spectrum Planning and the National Table of Frequency Allocations (NTFA)

National choices

- Using the international Table of Frequency Allocations as the source document, work through each frequency band to decide which service allocations are required nationally and, in the case where there is more than one organisation responsible for frequency assignments (for example government and non-government use), decide how frequency bands (or parts of frequency bands) should be shared between the organisations concerned.
- Flexibility is possible with national allocations while maintaining conformity with the Radio Regulations. For example, only those international footnotes relevant to the country need to be applied as national footnotes. Also, in cases where, in the RR, a frequency band is allocated to several services, an administration may select which of those services may operate in its territory (choosing one or several) or may decide to split the band into sub-bands, each allocated to one or more services allocated in the RR.

National Table of Frequency Allocations – structure

- NTFA is a method for presenting the national spectrum plan in an easily understandable (tabular) format.
- NTFA is derived from the international table of frequency allocations (Art. 5 of RR), the same tabular structure is used as it may easily be adapted to show national allocations, simply by inserting additional columns.

7 National Frequency Use Information

- **Considerably more detailed planning is required at the national assignment level and this can be provided by a National Table of Frequency Use as a separate companion to, or as part of, the NTFA. For example:**
  - Detailed information about the assignment of frequencies or blocks of frequencies to different types of system (channelling plans)
  - Technical conditions for frequency access (e.g. power, bandwidth)
  - Licensing conditions for frequency access (individual licence, licence exempt etc)
  - Future re-allocations (repurposing) as a result of long term planning: *Assignment freezing; Reallocation roadmap*

8 Practical steps to develop a country's first NTFA

- Countries that are in the preliminary stages of introducing spectrum management may have to start with no spectrum plan. In this case, an outline NTFA can provide a helpful map to enable a logical approach to deciding how to allocate spectrum to services to meet national requirements.

8 Practical steps to develop a country's first NTFA

- Using the international allocation table, construct a draft NTFA by selecting the allocation "column" for the Region concerned as the base
- Identify and add all footnotes relevant for the Region and country concerned
- Identify and "reserve" in the draft NTFA the frequency bands used by all major "international" services, systems or applications which are already in use or are likely to be used in the country
- Identify and "reserve" in the draft NTFA all allocations which would be difficult to use without causing interference to (or receiving interference from) services in other countries operating in accordance with the Radio Regulations, even though such services might not be used in the country concerned
- Collect information on existing national frequency use.

8 Practical steps to develop a country's first NTFA

- **Examples of major "international" services, systems or applications:**
  - International services for maritime and aeronautical
  - Public mobile communications systems
  - Broadcasting (especially if there is an ITU Regional Allotment Plan)
  - Fixed services – use ITU-R recommended frequency arrangements
  - Non-public mobile systems. Unfortunately there are no ITU recommended channel arrangements, so it will be necessary to consider examples from other countries in the Region concerned and adopt the most common and comprehensive plans
  - Fixed and mobile satellite bands, (especially if there is an Allotment Plan)
  - Public protection and disaster relief radiocommunication systems (see Recommendation ITU-R M.2015)
  - Radionavigation and Radiolocation

8 Practical steps to develop a country's first NTFA

- **Examples of allocations or frequencies which would be difficult to use without causing interference to (or receiving interference from) services or systems in other countries operating in accordance with the Radio Regulations, even though such services might not be used in the country concerned:**
  - Primary Amateur Radio allocations
  - Radio astronomy (especially frequency bands where all emissions are prohibited)
  - Frequencies used for Industrial Scientific and Medical applications
  - Frequencies used for Short Range Devices. See ITU-R Recommendation SM.1896: Frequency ranges for global or regional harmonization of short-range devices (SRDs)

8 Practical steps to develop a country's first NTFA

Identification of existing national use

- Potential sources of information on existing national use: existing licensing and assignment records; request users to provide information from their own records.
- If some form of monitoring capability is available, especially mobile monitoring, it may be used to verify existing records of spectrum use. Where records are poor or non-existent, monitoring can be used to determine actual frequency use, including finding transmitter locations and control points by direction finding.
- When existing national use is added to the draft NTFA, it is most likely that some will not conform to the Radio Regulations or will be using frequencies within frequency bands identified for the "international" services and applications identified in the previous slides. A transition plan should be prepared for the migration of non-conforming use to the new plan.

8 Practical steps to develop a country's first NTFA

- Once the draft NTFA has been "populated" with the allocations and frequencies identified, the spectrum policy and strategy group can decide on a rational distribution of the spectrum between government and non-government uses.
- The spectrum for government use may be further sub-divided for particular departments: Defence; Transport (Maritime, Aeronautical) etc.
- The spectrum for non-government use may be considered for channelling arrangements, technical use conditions and licensing regimes

9 Publishing the NTFA and National Frequency Use Tables

- **With increasing global telecommunications and liberalization of telecommunications markets, it has become a necessity to publish the NTFA as an aid to investment and market planning.**
- **An on-line NTFA can provide:**
  - *a public electronic record which is readily available and with timely updating;*
  - *a tool for identifying and flagging future modifications to the NTFA, for newly-planned bands and/or services;*
  - *clear information about the actual use versus allocation of any particular band (in cases of public safety, defence and other restricted government use, these can be simply labelled as "government use" for example);*
  - *a source of online information that can be used to generate important statistics/analytics on spectrum use.*

10 Regional co-operation in presenting National Frequency Allocation Tables

- **There is considerable regional co-operation and harmonization in spectrum management. This has resulted in regional telecommunications organizations providing "one-stop-shop" frequency allocation and use information systems.**

Examples:

- The Inter-American Telecommunication Commission (CITEL) provides a Spectrum Allocation Database and a Mobile Services Database
- Southern African Development Community (SADC) countries have a Frequency Allocation Plan (SADC FAP)
- The Asia-Pacific Telecommunity (APT) has a Frequency Information System (AFIS)
- European Conference of Postal and Telecommunications Administrations (CEPT) has the ECO Frequency Information System (EFIS)

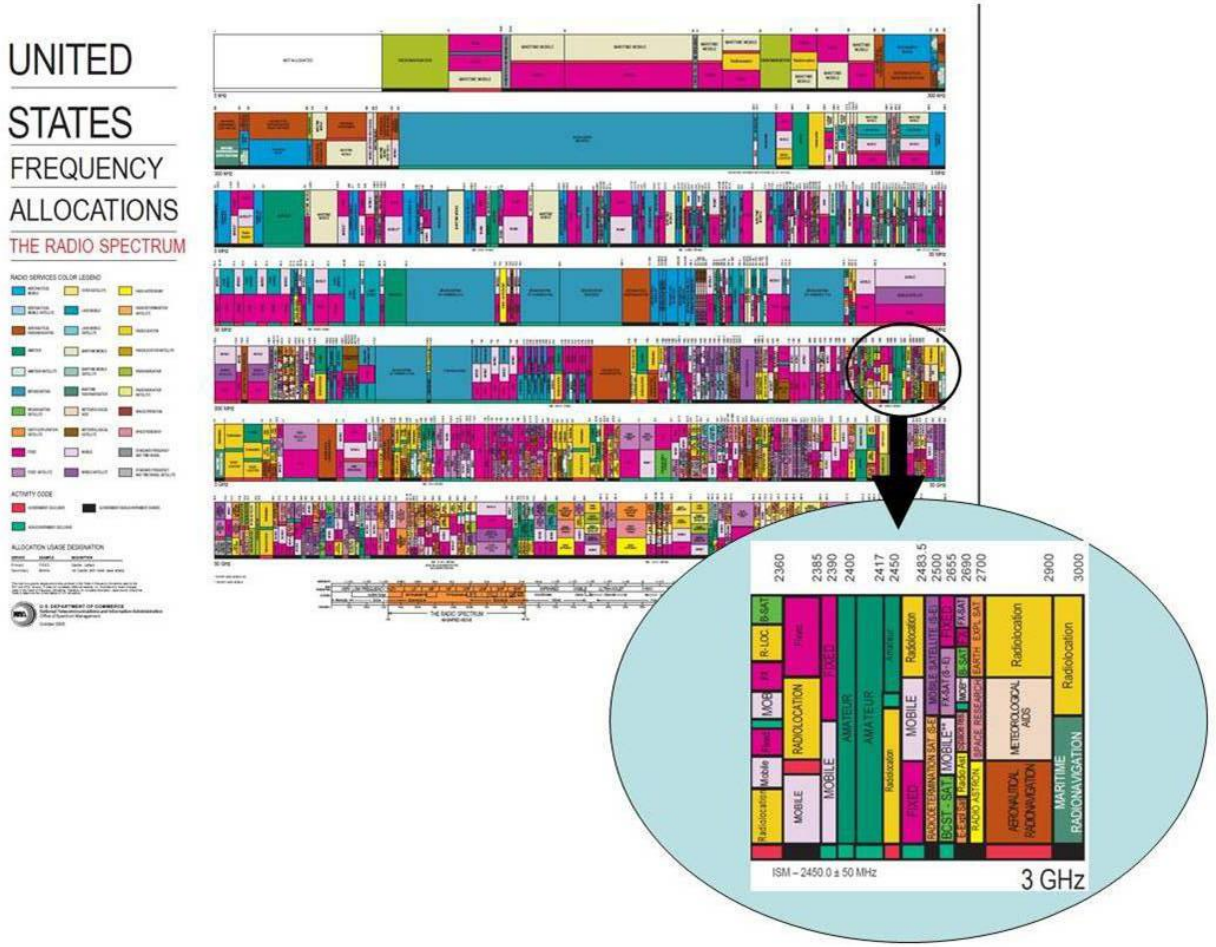
Example: Bahrain

- Somewhat more comprehensive providing more details of utilisation and some additional information

Frequency Allocation	ITU RR allocations for Region 1	National Allocations for Kingdom of Bahrain	Major utilization in Kingdom of Bahrain	Additional Information
1 710-2 025 MHz	1 710-1 930 FIXED MOBILE 5.384A 5.388A 5.388B 5.149 5.341 5.385 5.386 5.387 5.388	1 710-1 930 FIXED MOBILE 5.384A 5.388A 5.388B 5.149 5.341 5.385 5.388	Public fixed and mobile GSM1800 IMT candidate band (1710-1885 MHz) Op1 1735-1760 / 1830-1855 MHz, Op2 1780-1785 / 1875-1880 MHz GSM Guard band 1790 - 1795 MHz DECT 1880-1900 MHz IMT2000	1710-1785 MHz paired with 1805-1880 MHz 3rd mobile licence incl GSM1800 – 2x15 MHz IMT2000 TDD 1900-1920 MHz FDD 1920-1930 / 2110-2120 MHz
	1 930-1 970 FIXED MOBILE 5.388A 5.388	1 930-1 970 FIXED MOBILE 5.388A 5.388	Public fixed and mobile IMT2000 (FDD) 3 operators each with 2x15 MHz FDD & 5 MHz TDD	IMT2000 FDD 1930 – 1970 / 2120 – 2160 MHz
	1 970-1 980 FIXED MOBILE 5.388A 5.388	1 970-1 980 FIXED MOBILE 5.388A 5.388	 IMT2000 (FDD)	IMT2000 FDD 1970 – 1980 / 2160 – 2170 MHz
	1 980-2 010 FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) 5.351A 5.388 5.389A 5.389B 5.389F	1 980-2 010 FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) 5.351A 5.388 5.389A 5.389B 5.389F	 IMT2000 space segment	
	2 010-2 025 FIXED MOBILE 5.388A 5.388B 5.388	2 010-2 025 FIXED MOBILE 5.388A 5.388B 5.388	 IMT2000 (TDD)	
2 025-2 200 MHz	2 025-2 110 SPACE OPERATION (Earth-to-space) (space-to-space) EARTH EXPLORATION-SATELLITE (Earth-to-space) (space-to-space) FIXED MOBILE 5.391 SPACE RESEARCH (Earth-to-space) (space-to-space) 5.392	2 025-2 110 SPACE OPERATION (Earth-to-space) (space-to-space) EARTH EXPLORATION-SATELLITE (Earth-to-space) (space-to-space) FIXED MOBILE 5.391 SPACE RESEARCH (Earth-to-space) (space-to-space) 5.392	Government mobile	

Example: Graphical Representation

Useful for public consumption and a quick overview of the use of the radio spectrum



Example: UK NTFA

- Like other NRAs Ofcom publish a NTFA.

UNITED KINGDOM

FREQUENCY ALLOCATION TABLE

2013

Issue No. 17

Including
The International Telecommunication Union Table of Frequency Allocations contained in the current Radio Regulations

Issued by the National Frequency Planning Group on behalf of the Committee on UK Spectrum Strategy

Summary

- The NTFA is a core element of the national use of radio spectrum and will be one of the most important documents for the NRA
- Most countries adopt a similar format, using the RRs as a template and then showing the national use alongside this
- It can be helpful to provide informative notes, cross-references and footnotes so that most of the activities of the NRA can be “hung from” the NTFA
- Developing the NTFA is a large undertaking and once produced it will need regular updates
- Most NRAs now make the NTFA available on-line both as a published document and sometimes as a searchable database

Thank you!

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